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PUBLICATIONS / PATENTS / PRESENTATIONS / HONORS REPORT

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1 October 1989 through 30 September 1990

CONTRACT: N00014-86-K-0694

R&T NO:

TITLE OF CONTRACT: INTERFACIAL AND THIN FILM CHEMISTRY IN
ELECTRON DEVICE FABRICATION

NAMES OF PRINCIPAL INVESTIGATORS: Professors D. H. Auston, G. Flynn, E.
Fossum, I. Herman, R. Osgood, Jr., N. Turro, W. Wang and E. Yang.

NAME OF ORGANIZATION: Microelectronics Sciences Laboratories, Columbia
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PAPERS SUBMITTED TO REFEREED JOURNALS
(Not yet published)

Z. Lu, M. T. Schmidt, D. V. Podlesnik, C. F. Yu and R. M. Osgood, Jr., "Ultraviolet-Light-Induced Oxide Formation on GaAs Surfaces," sub. to J. Chem Phys. (March 1990)

P. S. Shaw, E. Sanchez, J. A. O'Neill, Z. Wu and R. M. Osgood, Jr., "Surface Photochemistry of Divalent Metal Alkyls on SiO₂," sub. to J. Chem. Phys. Let. (January 1990).

M. T. Schmidt, Z. Wu and R. M. Osgood, Jr., "A Marker Technique to Identify Diffusing Elements During Initial Reactions Using Ion Spectroscopy," sub. to Surface and Interface Analysis (April 1990).

T. J. Licata, M. T. Schmidt and R. M. Osgood, Jr., "The Application of Photodeposited Cd to Schottky Barrier Diode and MESFET Fabrication on InP and In_{0.47}Ga_{0.53}As Substrates," sub. to Appl. Phys. Let. (July 1990).

V. Liberman, G. Haase and R. M. Osgood, Jr., "Interaction of Cl₂ With GaAs(110) With and Without Laser Irradiation," sub. to Chem. Phys. Let. (September 1990).

M. T. Schmidt, Q. Y. Ma, L. S. Weinman, X. Wu, E. S. Yang, and Chin-An Chang, "Chemistry and Resistance at Metal Contacts to YBa₂Cu₃O₇ High T_c Superconducting Thin Films," to be published in the AIP Conference Proceedings Series, AVS 36th National Meeting, Boston, MA (October 1989).

Q. Y. Ma, E. S. Yang, G. V. Treyz, C. Shu, R. M. Osgood, Jr., and Chin-An Chang, "Use of Si-YBaCuO Intermixed System for Patterning of Superconducting Thin Films," to be published in the Proceedings of the MRS 89 Fall Meeting, Boston, MA, (Nov.-Dec., 1989).

J. C. Darrow, X. C. Zhang, and D. H. Auston, "Power Scaling of Large Aperture Photoconducting Antennas," sub. to Appl. Phys. Lett.

C. Shu, X. Wu, E. S. Yang, X. C. Zhang, and D. H. Auston, "Propagation Characteristics of Picosecond Electrical Pulses on a Periodically Loaded Coplanar Waveguide," sub. to IEEE MTT.

A-1

X.-C. Zhang, B. B. Hu, J. T. Darrow, and D. H. Auston, "Optically Induced Radiation from Semiconductor Surfaces," sub. to Appl. Phys. Lett.

Li. Xu, A. Hasegawa and D. H. Auston, "Propagation of Electromagnetic Solitary Waves in Dispersive Nonlinear Dielectrics," sub. to Phys. Rev. A.

C. Shu, B. B. Hu, X.-C. Zhang, P. Mei, and E. S. Yang, "Picosecond Photoconductive Response of Polycrystalline Silicon Thin Films," sub. to Appl. Phys. Lett.

John F. Hersherberger, Jeanne M. Hossenlopp, Yongsik Lee, and George W. Flynn, "Chemical Dynamics of the Reaction between Chlorine Atoms and Deuterated Cyclohexane," submitted for publication

K.F. Longenbach, L.F. Luo, and W.I. Wang, "Resonant Interband Tunneling in InAs/GaSb/AlSb/InAs and GaSb/InAs/AlSb/GaSb Heterostructures." Appl. Phys. Lett. accepted to appear Oct. 8, 1990.

K.F. Longenbach, L.F. Luo, and W.I. Wang, "Tunneling in Polytype InAs/AlSb/GaSb heterostructures." accepted to appear in the Proceedings of the NATO Advanced Workshop on Resonant Tunneling, Madrid, Spain, May 1990.

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H. Tang and I. Herman, "Raman Microprobe Scattering of Solid Silicon and Germanium at the Melting Temperature," sub. to Phys. Rev. B

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Q. Y. Ma, E. S. Yang and Chin-An Chang, "Rapid Thermal Annealing of YBaCuO Thin Films Deposited on SiO_2 Substrates," J. Appl. Phys. 66, 1866 (1989).

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J. Z. Chou, S. A. Hewitt, J. F. Hershberger, B. B. Brady, G. B. Spector, L. Chia, and G. W. Flynn, "Diode Laser Probing of the High Frequency Vibrational Modes of Baths of CO_2 , N_2O and CO Excited by Relaxation of Highly Excited NO_2 ," J. Chem. Phys. 91, 5392 (1989)

Jeanne M. Hossenlopp, John F. Hersberger, and George W. Flynn, "Kinetics and Product Vibrational Energy Disposal Dynamics in the Reaction of Chlorine Atoms with D₂S," J. Phys. Chem. 94, 1346 (1990)

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George W. Flynn, "Chemical Cartography: Finding the Keys to the Kinetic Labyrinth," Science. 246, 1009 (1989)

Farooq A. Khan, Thomas G. Kreutz, George W. Flynn, and Ralph E. Weston, Jr., "State Resolved Vibrational, Rotational, and Translational Energy Deposition in CO₂(00⁰1) Excited by Collisions with Hot Hydrogen Atoms," J. Chem. Phys. 92, 4876(1990)

Lei Zhu, Thomas G. Kreutz, and George W. Flynn, "Diode Laser Probing of Vibrational, Rotational, and Translational Excitation of CO₂ Following Collisions with O(¹D): Inelastic Scattering," 93, 3277(1990)

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V. Ramamurthy, D. R. Corbin, D. F. Eaton, and N. J. Turro, "Modification of Photochemical Reactivity by Zeolites: Role of Cations in Controlling the Behavior of Radicals Generated Within Faujasites," *Tetrahedron Letters* 30(43), 5833 (1989).

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Kuiri F. Tjipangandjara, Yi-Bin Huang, P. Somasundaran and Nicholas J. Turro, "Correlation of Alumina Flocculation with Adsorbed Polyacrylic Acid Conformation," *Colloids and Surfaces* 44, 229 (1990).

Andree Kursch-De Mesmaeker, Guillermo Orellana, Jaqueline K. Barton and Nicholas J. Turro, "Ligand-Dependent Interaction of Ruthenium(II) Polypyridyl Complexes with DNA Probed by Emission Spectroscopy," *Photochemistry and Photobiology* 52, 461 (1990).

H. Tang and I. Herman, "Local Laser Induced Etching of Copper Films by Chlorine," *Mat. Res. Soc. Symp. Proc.* 158, 331 (1990).

H. Tang and I. Herman, "Laser-induced and Room Temperature Etching of Copper Films by Chlorine with Analysis by Raman Spectroscopy," *J. Vac. Sci. Technol.* A8, 1608 (1990).

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I. Herman, Invited Review of Laser Microfabrication: Thin Film Processes and Lithography, in MRS Bulletin, 15(5), 57 (1990).

TECHNICAL REPORTS PUBLISHED

none

BOOKS AND SECTIONS THEREOF SUBMITTED FOR PUBLICATION

R. M. Osgood, Jr., Light Induced Surface Chemistry (in preparation)

BOOKS AND SECTIONS THEREOF PUBLISHED

D. H. Auston, "Picosecond Photoconductivity: High Speed Measurements of Devices and Materials," to be published as a chapter of the book: *Probing High Speed Electrical Signals*, edited by R. B. Marcus, Academic Press, (1989).

PATENTS FILED

D. H. Auston and X. C. Zhang, "Large Aperture Photoconducting Antennas," in preparation.

D. H. Auston and X. C. Zhang, "Noncontacting Probing of Semiconductor Surfaces with Femtosecond Optical Pulses," in preparation.

PATENTS GRANTED

none

INVITED PRESENTATIONS AT TOPICAL
OR SCIENTIFIC/TECHNICAL SOCIETY CONFERENCES

MATERIALS RESEARCH SOCIETY SYMPOSIUM, Boston, MA, October, 1989, "Use of Si-YBaCuO Intermixed System for Patterning of Superconducting Thin Films," Q. Y. Ma

SURFACE ANALYSIS AND INTERFACE ANALYSIS, Albuquerque, New Mexico, April 25-27, 1990, 12th Annual Symposium on Applied Surface Analysis, "A Marker Technique to Identify Diffusing Elements During Initial Reactions Using Ion Scattering Spectroscopy," Michael Schmidt

GORDON CONFERENCE ON THE CHEMISTRY OF ELECTRONIC MATERIALS, Ventura, CA, February, 1990, "Chemical Structure of the GaAs-Oxide Formed by Deep Ultraviolet Light Enhanced Growth," Michael T. Schmidt, Zhong Lu, Dragan V. Podlesnik, and Richard M. Osgood, Jr.

ELECTROCHEMICAL SOCIETY, Montreal, Canada, May 6-11, 1990, SOTAPOCS, "Etch Rate and Feature Size in the Micrometer Scale, Laser-enhanced Aqueous Etching of III-V Semiconductors," Xiaoge Zhang

ELECTROCHEMICAL SOCIETY, Montreal, Canada, May 6-11, 1990, SOTAPOCS, "Laser Electrochemical Etching of SiC," Xiaoge Zhang

APS MEETING, Anaheim, CA, March 1990, "Studies of Thin Metal Contacts to High T_c Superconducting Films," Q. Y. Ma, M. T. Schmidt, L. S. Weinman, E. S. Yang, and Chin-An Chang

OE/AEROSPACE SENSING CONFERENCE, "Superconductivity Applications for Infrared and Microwave Devices," Symposium, Orlando, FL, April, 1990, "Patterning of High T_c Superconducting Thin Films on Si Substrates," Q. Y. Ma, C. Shu, E. S. Yang, and Chin-An Chang.

ROCKWELL SCIENCE RESEARCH CENTER, CA, March 18, 1990, "Transition Characterization of Heterostructure-Emitter Bipolar Transistor," X. Wu.

RUTGERS UNIVERSITY, DEPT. OF ELECTRICAL ENGINEERING, NJ, May 19, 1990, "Low Temperature Performance of AlGaAs/GaAs Heterostructure-Emitter Bipolar Transistor," X. Wu.

LITTON SOLID STATE ELECTRONICS, INC. CA, May 28, 1990, "Surface Chemical Passivation of AlGaAs/GaAs Heterostructure Transistor," X. Wu.

MARYLAND UNIVERSITY, CENTER FOR SUPERCONDUCTIVITY, MD, May 15, 1990, "Physical and Material Properties of HTS Thin Films," Q. Y. Ma.

MCMASTER UNIVERSITY, MATERIALS RESEARCH INSTITUTE, CANADA, June 2, 1990, "Interfacial Properties of Metal-YBCO Contacts," Q. Y. Ma.

CONDUCTUS, INC., CA, Feb. 3, 1990, "Material Characterization of Si-YBCO Intermixed Films," Q. Y. Ma.

MICROELECTRONICS AND COMPUTER TECHNOLOGY CORP., TX, June 14, 1990, "Processing, Characterization, and Device Development of HTS films," Q. Y. Ma.

STANFORD UNIVERSITY, January 1990, "Generation and Detection of Femtosecond Electromagnetic Pulses," D. Auston.

UNIVERSITY OF TEXAS, February 15, 1990, "Ultrafast Optoelectronics," D. Auston.

PRINCETON UNIVERSITY, February 22, 1990, "Ultrafast Optoelectronics," D. Auston.

NATIONAL RESEARCH COUNCIL, Ottawa, February 27, 1990, "Ultrafast Optoelectronics," D. Auston.

AMERICAN PHYSICAL SOCIETY, March 1990, "Generation of Femtosecond Electromagnetic Pulses at Semiconductor Surfaces," D. Auston.

LOS ALAMOS NATIONAL LABORATORY, March 16, 1990, "Ultrafast Optoelectronics," D. Auston.

IEEE CHAPTER, Chicago, March 1990, "Ultrafast Optoelectronics," D. Auston.

GTE LABORATORY, Boston, April 12, 1990, "Ultrafast Optoelectronics," D. Auston

GEORGIA INSTITUTE OF TECHNOLOGY, April 17, 1990, "Ultrafast Optoelectronics," D. Auston.

UNIVERSITY OF MARYLAND, May 8, 1990, "Ultrafast Optoelectronics," D. Auston.

LASERS AND ELECTRO-OPTICS CONFERENCE, Anaheim, May 1990, "Large Aperture Photoconducting Antennas," D. Auston.

OSA TOPICAL MEETING ON ULTRAFAST PHENOMENA, Monterey, May 15, 1990, "Generation of Femtosecond Electromagnetic Pulses at Semiconductor Surfaces," D. Auston.

ALLIED SIGNAL CORPORATE RESEARCH LAB, Morristown, NJ, September 18, 1990, "Ultrafast Optoelectronics," D. Auston

SWISS FEDERAL INSTITUTE OF TECHNOLOGY (ETH), Zurich, September 29, 1989, "Super High Resolution Studies of Chemical and Collision Dynamics," G. W. Flynn.

NEW YORK ACADEMY OF SCIENCES, SYMPOSIUM ON SCIENCE AND TECHNOLOGY, New York, NY, April 25, 1990, "Infrared Laser Cartography: Vibrational, Rotational and Translational Energy Probes of Chemical and Collision Dynamics," G. W. Flynn.

AMERICAN CHEMICAL SOCIETY, SYMPOSIUM ON INTERMOLECULAR POTENTIALS: SPECTROSCOPIC, THEORETICAL AND DYNAMICAL PROBES, Washington, DC, August 28, 1990, "Infrared Laser Cartography: Vibrational, Rotational and Translational Energy Probes of Chemical and Collision Dynamics," G. W. Flynn.

CIBA-GEIGY RESEARCH LABORATORIES, Ardsley, NY, December 5, 1989, "Mechanisms of Photostabilization of Polymers," N. Turro.

BOWLING GREEN, BOLLING GREEN, OH. March 24, 1990, "Photochemistry in Restricted Spaces," N. Turro.

UNIVERSITY OF OKLAHOMA, May 3, 1990, "Novel Mechanisms of Photoreactivity at Interfaces," N. Turro.

ORGANIC REACTION MECHANISMS CONFERENCE, Boulder, CO, June 11, 1990, "Photochemical Reactions in Nanoscopic Reactors," N. Turro.

REACTION MECHANISMS IN SOLUTION CONFERENCE, Canterbury England, July 4, 1990, "Photochemistry and the Cage Effect," N. Turro.

UNIVERSITA DEGLI STUDI DI FIRENZE, Florence, Italy, July 12, 1990, "Photochemical Probes of Interfaces," N. Turro.

CONFERENCE ON SOLAR ENERGY CONVERSION AND STORAGE, Sicily, Italy, July 18, 1990, "Photoinduced Electron Transfer on Anionic Interfaces," N. Turro.

SYMPOSIUM ON PHOTOELECTRON TRANSFER, ASC NATIONAL MEETING, Washington, D.C., August 28, 1990, "Photoinduced Electron Transfer Between Metal Complexes Adsorbed on Micelles, Starburst Dendrimers and DNA," N. Turro.

UNILEVER RESEARCH LABORATORIES, USA, Edgewater, NJ, "Photochemical Probes for the Structure and Dynamics of Interfaces," August 24, 1990, N. Turro.

20TH INTERNATIONAL CONFERENCE ON THE PHYSICS OF SEMICONDUCTORS, Thessaloniki, Greece, August 6-10, 1990, "Optically Induced Screening of the Strain Induced Electric Fields in (111) GaSb/AlSb Quantum Wells," B.V. Shanabrook, D. Gammon, R. Beresford, W.I. Wang, and R.P. Leavitt.

SIXTH INTERNATIONAL CONFERENCE ON MOLECULAR BEAM EPITAXY, San Diego, CA., August, 1990, "Resonant Tunneling in Polytype InAs/AlSb/GaSb Heterostructures," K.F. Longenbach, L.F. Luo, S. Xin and W.I. Wang.

48TH DEVICE RESEARCH CONFERENCE, UC Santa Barbara, CA, June 25-27, 1990, "Large Bandwidth (13KHz-1 GHz) Planar-doped 2DEG CCD with High Transfer Efficiency at Room Temperature," J.I. Song, D.V. Rossi, S. Xin, W.I. Wang, and E.R. Fossum.

IBM EAST FISHKILL FACILITY, January 16, 1990, I. Herman

STATE UNIVERSITY OF NEW YORK, STONY BROOK, NY, October 3, 1989, I. Herman.

HONORS/AWARDS/PRIZES

Q. Y. Ma, Graduate Student Award, Materials Research Society, 1989 Fall Meeting in Boston.

R. M. Osgood, Jr., Honored by Japanese Electrooptics Organization (1990) for work in laser processing.

G. W. Flynn, Distinguished Visiting Scientist, Joint Institute for Laboratory Astrophysics, April 1989.

D. H. Auston, Quantum Electronics Award of the IEEE, 1990.

I. Herman, Invited to teach two courses in "Laser Processing," at CLEO '90 Meeting, May 1990.

GRADUATE STUDENTS SUPPORTED UNDER CONTRACT
FOR YEAR ENDING 30 SEPTEMBER 1990

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FOR YEAR ENDING 30 SEPTEMBER 1990

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Tom Kreutz (Post-Doctoral Fellow)
Qiyuan Ma (Post-Doctoral Fellow)
Jeunghee Park (Post-Doctoral Fellow)

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Xi-Cheng Zhang